

WHAT IS CLAIMED IS:

- 1      1.       A roller, comprising:
  - 2            a cylindrical core member, comprising a first portion having a first diameter, a second portion having a second diameter which is smaller than the first diameter, and a step portion continuously connecting the first portion and the second portion; and
  - 6            a rubber layer, secured to an outer periphery of the core member so as to cover the first portion and a part of the step portion.
- 1      2.       The roller as set forth in claim 1, wherein a longitudinal end portion of the rubber layer is protruded from the step portion in an axial direction of the core member, so as to have a flat face extending in a direction perpendicular to the axial direction.
- 1      3.       The roller as set forth in claim 1, wherein both of a boundary between the first portion and the step portion and a boundary between the step portion and the second portion are rounded.
- 1      4.       The roller as set forth in claim 1, wherein the first portion is formed by applying a hydroforming work to a cylindrical member having the second diameter.
- 1      5.       The roller as set forth in claim 1, wherein the second portion is formed by applying a plastic work to a cylindrical member having the first diameter.

- 1       6.     The roller as set forth in claim 1, wherein:
- 2              the second portion is formed by applying a mechanical work to a
- 3              cylindrical member having the first diameter; and
- 4              the rubber layer is secured so as to avoid a portion where the
- 5              mechanical work is applied.
- 1       7.     A device for fixing a toner image on a recording medium, comprising:
- 2              a first roller, in which a heat source is incorporated; and
- 3              a second roller, brought into contact with the first roller to form a nip
- 4              portion therebetween through which the recording medium is passed,
- 5              wherein at least one of the first roller and the second roller comprises:
- 6                  a cylindrical core member, comprising a first portion having a first
- 7              diameter, a second portion having a second diameter which is smaller than the
- 8              first diameter, and a step portion continuously connecting the first portion and
- 9              the second portion; and
- 10              a rubber layer, secured to an outer periphery of the core member
- 11              so as to cover the first portion and a part of the step portion.
- 1       8.     A device for fixing a toner image on a recording medium, comprising:
- 2              a first roller, in which a heat source is incorporated;
- 3              a heat-resistant belt member, stretched by a second roller and a
- 4              stretcher and circulated therearound, the belt member brought into contact with
- 5              the first roller to form a nip portion therebetween through which the recording
- 6              medium is passed,

7           wherein at least one of the first roller and the second roller comprises:  
8                a cylindrical core member, comprising a first portion having a first  
9           diameter, a second portion having a second diameter which is smaller than the  
10          first diameter, and a step portion continuously connecting the first portion and  
11          the second portion; and  
12                a rubber layer, secured to an outer periphery of the core member  
13          so as to cover the first portion and a part of the step portion.

1       9.       An image forming apparatus for forming a toner image on a recording  
2       medium, the apparatus comprising the device for fixing the toner image on the  
3       recording medium, as set forth in claim 7.

1       10.      An image forming apparatus for forming a toner image on a recording  
2       medium, the apparatus comprising the device for fixing the toner image on the  
3       recording medium, as set forth in claim 8.

1       11.      A roller, comprising:  
2                a cylindrical core member, comprising a first portion having a first  
3           diameter, a second portion having a second diameter which is smaller than the  
4           first diameter, and a step portion continuously connecting the first portion and  
5           the second portion; and  
6                a rubber layer, secured to an outer periphery of the core member so  
7          as to cover the first portion, the step portion and a part of the second portion.

1       12.     The roller as set forth in claim 11, wherein a longitudinal end portion  
2     of the rubber layer is protruded from the step portion in an axial direction of the  
3     core member, so as to have a flat face extending in a direction perpendicular  
4     to the axial direction.

1       13.     The roller as set forth in claim 11, wherein both of a boundary  
2     between the first portion and the step portion and a boundary between the step  
3     portion and the second portion are rounded.

1       14.     The roller as set forth in claim 11, wherein the first portion is formed  
2     by applying a hydroforming work to a cylindrical member having the second  
3     diameter.

1       15.     The roller as set forth in claim 11, wherein the second portion is  
2     formed by applying a plastic work to a cylindrical member having the first  
3     diameter.

1       16.     The roller as set forth in claim 11, wherein:  
2              the second portion is formed by applying a mechanical work to a  
3              cylindrical member having the first diameter; and  
4              the rubber layer is secured so as to cover a portion where the  
5              mechanical work is applied.

1       17.     A device for fixing a toner image on a recording medium, comprising:  
2              a first roller, in which a heat source is incorporated; and

3           a second roller, brought into contact with the first roller to form a nip  
4       portion therebetween through which the recording medium is passed,  
5           wherein at least one of the first roller and the second roller comprises:  
6            a cylindrical core member, comprising a first portion having a first  
7       diameter, a second portion having a second diameter which is smaller than the  
8       first diameter, and a step portion continuously connecting the first portion and  
9       the second portion; and  
10          a rubber layer, secured to an outer periphery of the core member  
11       so as to cover the first portion, the step portion and a part of the second  
12       portion.

1       18.     A device for fixing a toner image on a recording medium, comprising:  
2            a first roller, in which a heat source is incorporated;  
3            a heat-resistant belt member, stretched by a second roller and a  
4       stretcher and circulated therearound, the belt member brought into contact with  
5       the first roller to form a nip portion therebetween through which the recording  
6       medium is passed,  
7            wherein at least one of the first roller and the second roller comprises:  
8            a cylindrical core member, comprising a first portion having a first  
9       diameter, a second portion having a second diameter which is smaller than the  
10      first diameter, and a step portion continuously connecting the first portion and  
11      the second portion; and  
12          a rubber layer, secured to an outer periphery of the core member  
13       so as to cover the first portion the step portion and a part of the second  
14       portion.

1       19. An image forming apparatus for forming a toner image on a recording  
2 medium, the apparatus comprising the device for fixing the toner image on the  
3 recording medium, as set forth in claim 17.

1       20. An image forming apparatus for forming a toner image on a recording  
2 medium, the apparatus comprising the device for fixing the toner image on the  
3 recording medium, as set forth in claim 18.

1       21. A roller, comprising:

2              a cylindrical core member, comprising a first portion having a first  
3 diameter, a second portion having a second diameter which is smaller than the  
4 first diameter, and a step portion continuously connecting the first portion and  
5 the second portion;

6              a rubber layer, secured to an outer periphery of the core member so  
7 as to cover the first portion, the step portion and a part of the second portion;  
8 and

9              a support member, provided on the rubber layer situated in the  
10 second portion so as to rotatably support the core member.

1       22. The roller as set forth in claim 21, wherein a longitudinal end portion  
2 of the rubber layer has a flat face extending in a direction perpendicular to an  
3 axial direction of the core member.

1       23.     The roller as set forth in claim 21, wherein both of a boundary  
2     between the first portion and the step portion and a boundary between the step  
3     portion and the second portion are rounded.

1       24.     The roller as set forth in claim 21, wherein the first portion is formed  
2     by applying a hydroforming work to a cylindrical member having the second  
3     diameter.

1       25.     The roller as set forth in claim 21, wherein the second portion is  
2     formed by applying a plastic work to a cylindrical member having the first  
3     diameter.

1       26.     The roller as set forth in claim 21, wherein:  
2              the second portion is formed by applying a mechanical work to a  
3     cylindrical member having the first diameter; and  
4              the rubber layer is secured so as to cover a portion where the  
5     mechanical work is applied.

1       27.     A device for fixing a toner image on a recording medium, comprising:  
2              a first roller, in which a heat source is incorporated; and  
3              a second roller, brought into contact with the first roller to form a nip  
4     portion therebetween through which the recording medium is passed,  
5              wherein at least one of the first roller and the second roller comprises:  
6                  a cylindrical core member, comprising a first portion having a first  
7     diameter, a second portion having a second diameter which is smaller than the

8       first diameter, and a step portion continuously connecting the first portion and  
9       the second portion;

10            a rubber layer, secured to an outer periphery of the core member  
11       so as to cover the first portion, the step portion and a part of the second  
12       portion; and

13            a support member, provided on the rubber layer situated in the  
14       second portion so as to rotatably support the core member.

1       28.       A device for fixing a toner image on a recording medium, comprising:  
2            a first roller, in which a heat source is incorporated;  
3            a heat-resistant belt member, stretched by a second roller and a  
4       stretcher and circulated therearound, the belt member brought into contact with  
5       the first roller to form a nip portion therebetween through which the recording  
6       medium is passed,

7            wherein at least one of the first roller and the second roller comprises:  
8            a cylindrical core member, comprising a first portion having a first  
9       diameter, a second portion having a second diameter which is smaller than the  
10      first diameter, and a step portion continuously connecting the first portion and  
11      the second portion; and

12            a rubber layer, secured to an outer periphery of the core member  
13       so as to cover the first portion the step portion and a part of the second  
14       portion; and

15            a support member, provided on the rubber layer situated in the  
16       second portion so as to rotatably support the core member.

1       29. An image forming apparatus for forming a toner image on a recording  
2       medium, the apparatus comprising the device for fixing the toner image on the  
3       recording medium, as set forth in claim 27.

1       30. An image forming apparatus for forming a toner image on a recording  
2       medium, the apparatus comprising the device for fixing the toner image on the  
3       recording medium, as set forth in claim 28.

1       31. A device for fixing a toner image on a recording medium, comprising:  
2              a first roller, comprising:  
3                  a heat source;  
4                  a rotatable, cylindrical first core member;  
5                  a first elastic member, rotatable together with the first core member;  
6                  a first rubber layer, secured to an outer periphery of the first core  
7       member; and  
8              a second roller, comprising:  
9                  a rotatable, cylindrical second core member;  
10                 a second elastic member, rotatable together with the second core  
11       member; and  
12                 a second rubber layer, secured to an outer periphery of the second  
13       core member, and brought into contact with the first rubber layer to form a nip  
14       portion therebetween through which the recording medium is passed, and such  
15       that one of the first roller and the second roller is rotated by the rotation of the  
16       other,  
17                 wherein the first elastic member and the second elastic member are

18       brought into contact with each other at a position where is other than the nip  
19       portion.

1       32.      A device for fixing a toner image on a recording medium, comprising:  
2                a first roller, comprising:  
3                    a heat source;  
4                    a rotatable, cylindrical first core member;  
5                    a first elastic member, rotatable together with the first core member;  
6                    a first rubber layer, secured to an outer periphery of the first core  
7        member; and  
8                    a heat-resistant belt member, stretched by a second roller and a  
9        stretcher and circulated therearound, the second roller, comprising:  
10                  a rotatable, cylindrical second core member;  
11                  a second elastic member, rotatable together with the second core  
12        member; and  
13                  a second rubber layer, secured to an outer periphery of the second  
14        core member, wherein:  
15                  the belt member is brought into contact with the first rubber layer to  
16        form a nip portion therebetween through which the recording medium is  
17        passed; and  
18                  the first elastic member and the second elastic member are brought  
19        into contact with each other at a position where is other than the nip portion.

1       33.      The fixing device as set forth in claim 31, wherein:  
2                  the first elastic member has a hardness which is lower than a

3        hardness of the first rubber layer; and  
4                the second elastic member has a hardness which is lower than a  
5        hardness of the second rubber layer.

1        34.      The fixing device as set forth in claim 32, wherein:  
2                the first elastic member has a hardness which is lower than a  
3        hardness of the first rubber layer; and  
4                the second elastic member has a hardness which is lower than a  
5        hardness of the second rubber layer.

1        35.      The fixing device as set forth in claim 31, further comprising:  
2                a first support member, which rotatably supports the first roller; and  
3                a second support member, which rotatably supports the second roller,  
4        wherein:  
5                the first elastic member is arranged closer to a longitudinal end of the  
6        first roller than the first support member; and  
7                the second elastic member is arranged closer to a longitudinal end of  
8        the second roller than the second support member.

1        36.      The fixing device as set forth in claim 32, further comprising:  
2                a first support member, which rotatably supports the first roller; and  
3                a second support member, which rotatably supports the second roller,  
4        wherein:  
5                the first elastic member is arranged closer to a longitudinal end of the  
6        first roller than the first support member; and

7                   the second elastic member is arranged closer to a longitudinal end of  
8                   the second roller than the second support member.

1       37.       The fixing device as set forth in claim 35, wherein:  
2                   the first support member and the first elastic member are provided at  
3                   each of longitudinal ends of the first roller; and  
4                   the second support member and the second elastic member are  
5                   provided at each of longitudinal ends of the second roller.

1       38.       The fixing device as set forth in claim 36, wherein:  
2                   the first support member and the first elastic member are provided at  
3                   each of longitudinal ends of the first roller; and  
4                   the second support member and the second elastic member are  
5                   provided at each of longitudinal ends of the second roller.

1       39.       An image forming apparatus for forming a toner image on a recording  
2                   medium, the apparatus comprising the device for fixing the toner image on the  
3                   recording medium, as set forth in claim 31.

1       40.       An image forming apparatus for forming a toner image on a recording  
2                   medium, the apparatus comprising the device for fixing the toner image on the  
3                   recording medium, as set forth in claim 32.